

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 2818

In re application of : August 26, 2008  
Michael C. Gaidis : Examiner: David J. Goodwin  
Serial No. : 10/559,960 :  
Filed: December 8, 2005 : IBM Corporation  
Title: SELF-ALIGNED CONDUCTIVE : Dept. 18G/Bldg, 321-482  
LINES FOR FET-BASED MAGNETIC : 2070 Route 52  
RANDOM ACCESS MEMORY : Hopewell Junction, NY  
DEVICES AND METHOD OF FORMING : 12533-6531  
THE SAME

APPEAL BRIEF

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

Sir:

This is an appeal from the March 27, 2008 Final Rejection of claims 1 - 7.  
A correct copy of the claims is attached in Appendix A.

Real Party in Interest

The real party in interest is International Business Machines Corporation  
per an assignment recorded in the US Patent and Trademark Office at  
Reel/Frame: 017445 / 0875 on January 9, 2006.

Related Appeals and Interferences

None.

### **Status of Claims**

Claims 1 - 7 are pending. Claims 8-15 have been canceled. There are no other claims in the application. Claims 1 - 7 are the appealed claims.

### **Status of Amendments**

An amendment after final rejection was submitted on June 9, 2008 to cancel claims 8 -15. An advisory action was mailed on July 10, 2008, however the advisory action did not expressly indicate whether or not the amendment was entered. Given that the amendment after final was merely a cancelation of claims, appellant assumes that the amendment was entered or will be entered.

### **Summary of the Claimed Subject Matter**

The invention centers on an improved configuration of metal features for an FET-based MRAM device. The invention addresses the problems discussed at page 3, line 5-18 of the specification. Thus, the invention advantageously minimizes the occurrence of shorting between the M2 line and the strap connecting the FET caused by micro-trenching while enabling a reduction in the metal shield thickness for improved performance.

Figure 3f provides a cross section of the claimed structure. Specifically, the device of the invention is characterized in part by the presence of a metal shield (324) and conductive strap (326) which are self-aligned with respect to each other and are substantially coextensive. See the specification at page 7, lines 4-6 and page 9, lines 21-25. These portions of the specification and figures 3c and 3d describe the patterning that occurs to convert layers 320 and 310 into the metal shield 324 and conductive strap 326 respectively where the patterned layer 320 (now shield 324) acts as a mask for the underlying layers including layer 310 (which becomes conductive strap 326). The term "substantially" is

intended to cover any minor deviations in the pattern transfer process fidelity which can be implied from the discussion of pattern transfer on page 9, lines 21-25 of the specification.

**Grounds of Rejection to be Reviewed on Appeal**

1. Claims 1, 2, 3, 6 and 7 are rejected under 35 USC 102(e) as being anticipated by US Pat. 6,909,630 (Tsang).
2. Claims 4 and 5 are rejected under 35 USC 103(a) as being unpatentable over Tsang in view of US Pat. 6,806,096 (Kim et al.).

**Argument**

1. **Claims 1, 2, 3, 6 and 7 are rejected under 35 USC 102(e) as being anticipated by US Pat. 6,909,630 (Tsang).**

Tsang (US Pat. 6909630) discloses a conventional MRAM-FET configuration where the capping layer (3104) is not substantially coextensive with the conductive layer (79). Note Figure 7 of Tsang. Tsang is silent on the concept of coextensiveness, much less the idea that capping layer 3104 be coextensive with conductive layer 79. The manufacturing process described by Tsang at col. 9, lines 20-50 and Figure 7 would not result in a structure where regions 3104 and 79 are substantially coextensive. Thus, appellant submits that Tsang does not disclose or suggest a conductive line structure for FET-based magnetic random access memory (MRAM) device where the metal capping layer is substantially coextensive with the conductive strap for connection with the FET.

Regarding the position stated in the official action that Tsang discloses an overlying metal layer that is coextensive with the underlying metal strap, appellant submits that this interpretation is not supported by Figure 7 of Tsang which shows that conductive layer 79 extends far beyond capping layer 3104. Appellant submits that the official action appears to misconstrue the term "coextensive" as is normally understood in the art. Otherwise, appellant is hard-pressed to see how one could conclude that layers 79 and 3104 of Tsang could be considered as being coextensive.

**2. Claims 4 and 5 are rejected under 35 USC 103(a) as being unpatentable over Tsang in view of US Pat. 6,806,096 (Kim et al.).**

Appellant's comments above regarding Tsang with respect to claims 1, 2, 3, 6 and 7 apply equally to claims 4 and 5.

The combination of Tsang with Kim et al. fails to cure the deficiencies of Tsang. Specifically, Kim et al. (US Pat. 6806096) discloses an MRAM cell of similar configuration as Tsang in that the conductive strap is not substantially coextensive with the metal shield which contacts the bitline. Thus, the combination of Tsang and Kim et al. fails to disclose or suggest a conductive line structure for FET-based magnetic random access memory (MRAM) device where the metal capping layer is substantially coextensive with the conductive strap for connection with the FET.

**Conclusion**

Based on the above arguments, appellant submits that the present claims are patentable over the prior art of record and that the rejections under 35 USC 102(e) and 35 USC 103(a) should be reversed.

Respectfully submitted,

Michael C. Gaidis

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## Appendix A

### Claims on Appeal

1. A conductive line structure for a field effect transistor (FET) based magnetic random access memory (MRAM) device, comprising:
  - a lateral metal strap conductively coupled to a lower metallization line;
  - a magnetic tunnel junction (MTJ) stack formed on said metal strap;
  - a metal shield formed over said MTJ stack, said metal shield being substantially coextensive with said metal strap; and
  - an upper metallization line conductively coupled to said metal shield, wherein said metal shield serves as an etch stop during the formation of said upper metallization line.
2. The structure of claim 1, wherein said MTJ stack further comprises:
  - a non-magnetic layer formed between a lower magnetic layer and an upper magnetic layer; and
  - a metal hardmask layer formed on said upper magnetic layer;

wherein the distance between said upper metallization line and said upper magnetic layer is defined by a total thickness of said metal hardmask layer and said metal shield.
3. The structure of claim 2, wherein said total thickness of said metal hardmask layer and said metal shield is about 400 to about 500 angstroms.
4. The structure of claim 1, wherein said metal shield comprises one of: tantalum, tantalum nitride, titanium nitride, tungsten, platinum, and combinations comprising at least one of the foregoing.

5. The structure of claim 1, wherein said metal hardmask layer and said metal strap comprise one of: tantalum, tantalum nitride, titanium nitride, tungsten, platinum, and combinations comprising at least one of the foregoing.

6. (original) The structure of claim 1, wherein: said lower metallization line is formed at first metallization level (M1) of the MRAM device, and said upper metallization line is formed at a second metallization level (M2) of the MRAM device.

7. (original) The structure of claim 1, further comprising:

    a wordline formed at a lower metallization level (M1) and adjacent said lower metallization line, said wordline electrically insulated from said lateral metal strap, and said wordline disposed below said MTJ stack;

    wherein said upper metallization line comprises a bitline of an individual MRAM cell, said cell also including said MTJ stack and said wordline.

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Appendix B

**Evidence Appendix**

None.

[End of Appendix B]

## Appendix C

### **Related Proceedings Appendix**

None.

[End of Appendix C]